

# Sergo R. Jindariani

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Fermilab  
P.O.Box 500  
MS 318  
Batavia, IL 60510-0500

Phone: (630) 840-2433  
Fax: (630) 840-8859  
[sergo@fnal.gov](mailto:sergo@fnal.gov)  
<http://www.fnal.gov/~sergo/>

## Professional Experience

2007 Nov - present, Research Associate, Fermi National Accelerator Laboratory

2003 May - 2007 Nov, Research Assistant, University of Florida

2002 Aug - 2003 May, Teaching Assistant, University of Florida

2001 Sep - 2002 Aug, Research Assistant, Joint Institute for Nuclear Research (Dubna, Russia)

## Education

Ph.D. Physics, University of Florida, Gainesville, FL 2007  
Dissertation: "Fragmentation of jets produced in  $p\bar{p}$  collisions at  $\sqrt{s}=1.96$  TeV"  
Advisor: Prof. A.Korytov

B.S. Physics, Tbilisi State University, Tbilisi, Georgia 2001, *Summa Cum Laude*

## Research Experience

03/2009–current:

- Co-Leader of CDF's heavy mass Higgs group. The group is in charge of coordinating, guiding and reviewing searches for heavy mass Higgs Boson and measurements of the associated diboson cross-sections. The group consists of 20 regularly attending members, and 50 are subscribed to a dedicated mailing list. Since I became co-leader of the group, we completed measurements of the  $WW$  and  $ZZ$  cross-sections and improved sensitivity to the Higgs Boson by approximately 50%, which led to the exclusion of Standard Model (SM) Higgs Boson in the range 162–166 GeV/c<sup>2</sup>. Half of the improvement came from addition of new final states, improved lepton identification and better optimization of the signal-background discriminants. The group's goal is to achieve CDF only exclusion in the next six months and extend the exclusion range in combination with D0. The group's work resulted in several Physics Review Letters and Physics Review D publications.

1/2009–1/2010:

- Co-Leader of CDF silicon project. The silicon group counts about 20 active members and is in charge of the CDF silicon detector ( multi-million dollar worth and most sensitive piece of equipment in the CDF detector) as well as studies of its properties and aging. Over 200 members are subscribed to the mailing list. As a project co-leader I was in charge of managing the group, recruiting and training silicon detector experts and pager carriers, coordinating day-to-day operation of the group, had ultimate authority on any decision regarding detector operation. Improved efficiency of data-taking and reduced workload by re-structuring group organization and automating most of the routine tasks. Performed and actively promoted studies of CDF silicon aging in radiation environment, results were presented at multiple international conferences. A NIM paper describing operational experience with CDF II silicon detectors is in preparation.

11/2007–current:

- Searched for a SM Higgs Boson in the  $H \rightarrow WW$  channel at the CDF experiment. The novel analysis consists of eight individual channels, each optimized separately to achieve best sensitivity to the Standard Model Higgs Boson. It utilizes multivariate techniques such as Matrix Element calculations and Neural Network for better discrimination of signal versus background. Specific contributions include development of Matrix Element discriminant code, optimization of the Neural Network, evaluation of lepton fake rates, incorporation of final states with hadronic tau decays and others. The most recent update of the  $H \rightarrow WW$  search has CDF-only sensitivity of  $1.2 \times$  Standard Model cross-section at  $M_H = 160$  GeV. Articles describing most recent CDF result and combination with D0 result are submitted to Physics Review Letters. Another article with detailed description of the search is in preparation for Physics Review D. Work on setting limits in the context of “4th generation models of quarks” is in progress, this will result in a separate publication.

2008–2009:

- Measured WW production cross-section using  $3.6 \text{ fb}^{-1}$  of CDF data. At the time, the analysis is the most precise measurement of the WW production cross-section in the world. The process is primary background in searches high mass Standard Model Higgs Boson. The analysis demonstrated that we have good modeling and understanding of the WW production, which is essential for Higgs searches in this channel. The constraints on anomalous  $WW\gamma$  and  $WWZ$  couplings are also placed. The publication summarizing results is submitted to Physics Review Letters.

2008–2009:

- As part of a group effort, measured ZZ production cross-section in the four-lepton decay channel using  $4.8 \text{ fb}^{-1}$  of CDF data. The analysis is the first CDF “observation” of the ZZ production with signal significance of  $5.7\sigma$ . Plan to improve the analysis and possibly apply techniques to the search for Standard Model Higgs boson in the ZZ decay channel.

05/2009-09/2009:

- Coordinated activities of the CDF silicon group during 2009 Tevatron shutdown. Initiated and lead repairs of the Isolated Silicon Layers (ISL) east cooling system, aimed to reduce leak rate and improve flow of coolant through the system. Steered efforts in repairs of over 20 silicon power supplies, that developed problems with low voltage channels due to the radiation. Worked on replacement of several key DAQ components which allowed to recover few percent of silicon detector channels. Improved performance of the CDF silicon tracker, took steps to prevent major failures, made sure that the detector is ready to run at high efficiency until the end of 2010 and beyond.

2007–2008:

- On-call expert for the CDF silicon detectors. Responsibilities included daily monitoring and maintenance of the detector, silicon pager shifts, as well as studies and mitigation of readout chip related problems affecting quality of data.

2004–2008:

- Together with Prof. Andrey Korytov (University of Florida) I was the driving force in soft QCD studies at CDF. These studies help unveil the internal dynamics of jets, expand our understanding of the relative roles of the perturbative and non-perturbative stages of jet formation, and probe the boundary between the parton shower and hadronization. We completed three data analyses over the course of four years, all three indicated that the pQCD stage of jet formation is dominant in shaping jet characteristics.

2006–2008:

- Performed first measurement of the of Event Shapes at the Tevatron. Generally, event shapes describe geometric properties of the energy flow in QCD final states. The analysis improves our understanding of the dynamics of soft perturbative QCD, as well as provides practical means of tuning Monte Carlo event generators. Publication is in preparation for Physics Review D.

2008:

- Investigated effect of silicon detector aging on Silicon Vertex Trigger (SVT) efficiency and made future projections. The projections were done by modifying raw silicon data according to the extrapolations of signal and noise as a function of integrated luminosity. The results indicated that up to  $8\text{ fb}^{-1}$  of integrated luminosity the drop in SVT efficiency is less than 5%.

2003–2005:

- Measured two-particle momentum correlations in jets produced in  $p\bar{p}$  collisions and compared the results to analytical predictions of the next-to-leading log approximation. The analysis is the first measurement of these correlations in hadron collider environment, and addresses the question of whether effects, such as momentum correlation at the parton level, survive hadronization. The results gave support to the hypothesis of Local Parton Hadron Duality and are published in Physics Review D.

2005–2007:

- Performed a measurement of the transverse momentum with respect to the jet axis ( $k_T$ ) of particles in jets produced in  $p\bar{p}$  collisions. The goal of the analysis was to test the Local Parton Hadron Duality hypothesis by examining whether the pQCD predictions for the transverse momentum distribution of partons can successfully reproduce the corresponding distribution for hadrons in experimental data. The most recent (2007) dedicated theoretical predictions were used for comparison with experimental data. Results are published in Physics Review Letters.

2004–2007:

- Contributed to operations of the Cherenkov Luminosity Counter (CLC) in Run II. Responsible for testing and installation of the hardware components (PMTs and PMT bases), studies of the CLC PMT gain stability, support and development of the CLC online and offline software, CLC pager shifts. Performed store-by-store amplitude and pedestal calibration of the detector. Supported CLC calibration database tools.

2007:

- Developed framework for automated store-by-store CLC calibration. The framework was designed to perform offline calibration of the detector upon completion of each Tevatron store. The expert role was minimized to visual inspection of calibration results. The framework is currently in use by the CLC group.

2003–2004:

- Worked on the development of software framework to determine the response of each CLC channel to particles from primary collisions with a systematic uncertainty of  $\sim 3\%$ , which results in associated systematic uncertainty of only  $\sim 1\%$  in measured luminosity. The amplitude calibration also allows for the monitoring of the detector stability and performance on a store-by-store basis.

2004:

- Served as a CDF DAQ and monitoring shifter on 12-week rotation. Responsible for high efficiency of data acquisition and the detector safety

2001–2002:

- Performed original research on the topic of phenomenology of very high multiplicity hadron processes. Mainly contributed to implementations of numerical methods for solving differential and integral equations with multiple variables.

### **Honors and Awards**

Red Diploma (summa cum laude), Tbilisi State University 2001

Recipient of George Soros Scholarship for outstanding students 1997-2000

Recipient of Georgian President thank you letter for academic excellence and leadership, 1997

Third prize, International Young Physicist Tournament 1996,1997

Silver medalist, National Mathematics Olympiad 1995,1996

Bronze medalist, National Physics Olympiad 1997

### **Conference and Seminar Presentations**

#### **“Searches for heavy Higgs boson at the Tevatron”**

Spring Symposium on Higgs Physics, University of Michigan, May 2010

#### **“Longevity Studies and Operational Experience with the CDF Run II silicon detectors”**

Vienna Conference on Instrumentation, Vienna, Austria, February 2010

#### **“Plans for high mass Higgs boson searches”**

CDF Collaboration meeting, Puerto Vallarta, Mexico, February 2010

#### **“High mass Higgs at the Tevatron”**

Hadron Collider Physics Symposium, Evian, France, November 2009

#### **”Soft QCD and the Underlying Event at the Tevatron”**

XVII International Workshop on Deep-Inelastic Scattering and Related Subjects, Madrid, Spain, April 2009

#### **“Road to SM Higgs boson sensitivity at CDF”**

Fermilab Joint Theoretical-Experimental Seminar (“Wine and Cheese”), FNAL, Batavia, IL, March 2009

#### **“Event Shapes at CDF”**

CDF Collaboration meeting, FNAL, Batavia, IL, October 2008

#### **“Search for Standard Model $H \rightarrow WW^*$ at CDF”**

Hadron Collider Physics Symposium, Galena, IL, May 24-31 2008

#### **“Studies of jet fragmentation at CDF”**

UCSB High Energy Physics Seminar, Santa Barbara, CA, July 23 2007

#### **“Jet fragmentation at CDF”**

Fermilab Research Associate Seminar, Batavia, IL, July 17 2007

#### **“Soft QCD and the underlying event”**

Hadron Collider Physics Symposium, La Biodola, Isola d’Elba, Italy, May 20-26 2007

#### **“Jet Fragmentation at CDF”**

APS 2007 April Meeting, Jacksonville, FL, April 14-17 2006

#### **“Latest Fragmentation Results at CDF”**

CDF Collaboration meeting, FNAL, Batavia, IL, October 2006

**“New Results on Jet Fragmentation at CDF”**

International Symposium on Multiparticle Dynamics, Rio de Janeiro, Brazil, September 02-08, 2006

**“New Jet Fragmentation Results at Tevatron”**

PHENO’06 Symposium, Madison, WI, May 15-17, 2006

**“Two-particle Momentum Correlations in Jets at Tevatron”**

APS 2006 April Meeting, Dallas, TX, April 22-25, 2006

**“Two-particle Momentum Correlations in Jets at Tevatron”**

SEAPS 2005 Meeting, Gainesville, FL, November 10-12, 2005

**“CDF Luminosity Studies”**

Joint CDF/D0/AD Luminosity Meeting, FNAL, Batavia, IL, November 1, 2005

**“Measurement of the Two-particle Momentum Correlations in Jets at CDF”**

Panic’05, Santa Fe, NM, October 27, 2005

Multiple CDF internal presentations for QCD, Higgs and Joint Physics groups.

**Teaching and Mentorship Experience**

**2009: Margaret Jezghani.** Margaret is undergraduate student from North Georgia College and University who came to Fermilab as summer intern and worked under my supervision on CDF silicon project. Margaret contributed to upgrades and maintenance of the silicon detector infrastructure. The paper summarizing her work is submitted to DOE sponsored Journal of Undergraduate Research. Margaret presented status of CDF silicon detectors at the Southeastern APS section meeting in Atlanta, Georgia. She is in process of applying to graduate schools.

**2008–2009: Britney Rutherford.** Britney is engineer physicist, who worked closely with me on the search for Standard Model Higgs boson in the  $WW$  decay channel. Britney contributed to production of data and Monte Carlo ntuples, evaluation of lepton ID efficiencies and fake rates. She is currently graduate student at University of California, Davis.

**2008–2009: Simone Pagan Griso.** Simone is graduate student at University of Padova who worked closely with me on the search for Standard Model Higgs boson in the  $WW$  decay channel. He contributed to many improvements in the analysis, including improved muon acceptance, Neural Network optimization, better modeling of Drell-Yan background, and others. Simone will continue career in physics as Chamberlain Fellow at LBL.

**2007–2008: Lester Pinera.** Lester graduated from University of Florida and worked closely with me on the first measurement of Event Shapes at the Tevatron, as well as upgrades and maintenance of the CLC software. He is now pursuing career in industry.

**2005–2007: Iuri Oksuzian.** Iuri is graduate student at University of Florida who worked closely with me on CLC amplitude and pedestal calibration software as well as performed studies of CLC performance and gain stability.

**2002–2003: Teaching Assistant, Department of Physics, University of Florida.** Taught discussion and laboratory sessions for the “Introductory Physics” and “Physics with Calculus” undergraduate courses.

**2002–2003 Private Tutor, Department of Physics, University of Florida.** Assisted undergraduate students in improving academic achievements by clarifying physics problems and helping to solve them.

**Public Outreach**

Gave tours of CDF collision hall to visitors (Fermilab, 2009).

Gave tours of Fermilab to high school students (Fermilab, 2007–2009).

Judged USA national Young Physicist Tournament (Jacksonville, FL, 2004).

Helped to train national team for the International Young Physicist Tournament (Georgia, 1999).

Judged national Young Physicist Tournament (Georgia, 1999).

Preparation and organization of regional and national level of physics Olympiads for high school students (Georgia, 1997-1998).

### **Technical Experience**

System Administrator, Geonet (Internet Service Provider), 08/1998–05/1999

Administered and upgraded Linux based ISP system, implemented IP-telephony service.